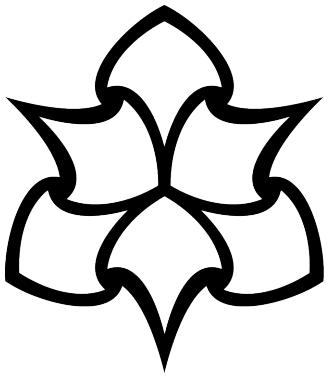

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SSS2.1: World land Degradation and Desertification. A human and biophysical approach

Land degradation and desertification monitoring using a multivariate statistical approach

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Land degradation and desertification (LDD) are causing the loss of fertile soils all over the world, depriving more and more people of arable land. In a European context, the most affected areas are found in the Mediterranean zone. The aim of the present study is to develop a monitoring system to identify the dynamic nature of environmental sensitivity of the 73 municipalities of the island of Lesvos (Greece) to LDD. We employ a modification of the widely applied Environmentally Sensitive Area Index (ESAI) with additional case-specific biophysical and socio-economic indices estimated using satellite imagery, field and census data in a Geographical Information System (GIS). The most frequently applied indicator-based system for assessing LDD in the Mediterranean region is the Environmentally Sensitive Area (ESA) framework, mainly due to its simplicity in model building as well as its flexibility in the use of relevant variables as indicators. However, the ESAI model weights all indicators equally, possibly underestimating the importance of some factors and inflating the importance of others. Here, we used multiway data analysis (MDA) to explicitly measure the variance in LDD between 1990 and 2000 for each of the 21 LDD indicators to inform a modified ESAI for the Lesvos dataset. Our results show that the majority of the island is in a critically sensitive environmental state. While LDD in the western part of the island improves in the second period of study, a finding which is consistent with other land degradation studies in the area, at a local scale this region is most sensitive to LDD. On the contrary, other parts of the island perform worse in the year 2000, perhaps due to economic activity in the eastern coastal areas as a result of urban growth, tourism and irrigation (i.e. littoralisation). While a significant correlation between our results and the ESAI was observed for both epochs, it is concluded that our approach may more accurately identify the causative factors influencing LDD by overcoming the methodological constraints of the ESAI procedure. The suggested methodology can be used for identifying sensitive areas where mitigation measures are required and thus provide a management tool for the prioritisation of such measures.